Amendments to the Drawings:

The attached sheets of drawings are merely formal drawings and include no substantive changes to Figures 1-6. These sheets, which include Figs. 1-6, replace the original sheets including Figs. 1-6.

Attachment: 6 Sheets of Replacement Drawings, Figs. 1-6.

REMARKS

Claims 1-29 will be pending upon entry of the present amendment. Claims 1, 4, 8-9, 12, and 24-25 are being amended. Claims 26-29 are new.

The applicants appreciate the indication that claims 4-11, 15-18, and 20-23 are directed to allowable subject matter. These claims are not being placed in independent form because the applicants respectfully submit that independent claims 1, 12, and 19, from which claims 4-11, 15-18, and 20-23 respectively depend, are in condition for allowance.

Claims 1-3, 12-14, 19, and 24-25 were rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,333,012 to Singhal et al. ("Singhal").

Singhal is directed to an image coder that employs variable rate encoding to encode a slice or frame that includes a plurality of macroblocks. Singhal employs a variance processor to determine an image variance $\sigma^2_y(i)$ between the A-C DCT coefficients within a given macroblock of an input image 4 and a differential variance $\sigma^2_x(i)$ between the A-C DCT coefficients within a given macroblock of a interframe differential image 5. A bit allocation processor 27 then allocates bits for the macroblock based on those variances and on a number of bits pre-assigned to a the slice or frame.

One embodiment of the present invention is directed to an image encoding method that goes beyond variable encoding at the macroblock level by dividing a sequence of pictures into segments that each include a plurality of pictures with each picture including plural macroblocks. Dividing the image sequence into segments enables the method to track and update a segment target bit rate so that an overall target bit rate remains substantially constant. The method does this by 1) calculating the segment target bit rate using the overall target bit rate; 2) determining a bit allocation and a target quantization step size for encoding a first segment based on the segment target bit rate; 3) encoding the first segment using variable bit rate encoding according to a target quantization step size; 4) determining a difference between the number of bits used to encode the first segment and the first segment bit allocation; and 5) calculating a new target segment bit rate and a new target quantization step size according to the difference and encoding according to the new target quantization step size.

An initial discussion of terminology may help to appreciate the differences between Singhal and the claimed invention. In MPEG terminology, a sequence refers to the overall image stream and includes a group of pictures (GOP) layer. Each GOP includes a number of pictures or frames, with each picture or frame including plural slices. Each slice includes a number of macroblocks and each macroblock includes a number of blocks (typically 6) of pixels. Singhal is operating at the frame/slice/macroblock levels while the preferred embodiment of the invention divides the sequences into segments that each include plural GOPs, each including plural pictures or frames.

Singhal does not disclose the invention recited in claim 1. Claim 1 recites a method for encoding a sequence of segments each having a plurality of pictures that each include plural macroblocks. Singhal does not disclose any of the steps of claim 1 primarily because Singhal does not disclose any steps operating on any features corresponding to such segments.

Turning to the specific steps of claim 1, Singhal does not determine an overall target bit rate for encoding the sequence. The Examiner points to column 5, lines 52-55 which discusses a target number of bits for each slice or frame. Such a target number of bits for a single slice or frame is not an overall target bit rate for the entire sequence of images being encoded by Singhal. In other words, Singhal does not suggest that the target number of bits for the single slice or frame could or should be used as an overall target bit rate for the entire sequence of images.

Singhal does not disclose determining a bit allocation and target quantization step size for encoding a first segment based on a segment target bit rate calculated using said overall target bit rate. First, the only bit rate pointed to by the Examiner is the target number of bits per slice or frame, which cannot possibly be both the overall target bit rate and the segment target bit rate. Second, Singhal does not disclose determining a target quantization step size for encoding a first segment based on any target bit rate. Instead, Singhal adjusts the quantization step size for each macroblock based on a coding efficiency factor C without determining any target quantization step size for an entire segment. That is, Singhal is concerned with incremental quantization step sizes at the macroblock level without having a target step size for an entire segment of macroblocks.

Singhal does not disclose encoding a first segment using a variable bit rate encoding method *according to the target quantization step size* even though Singhal is primarily directed to a variable bit rate encoding method. That is because, as discussed above, Singhal does not determine a target quantization step size for the first segment.

Singhal does not disclose determining a difference between the number of bits used to encode the first segment and the first segment bit allocation or distributing the difference for use in encoding a subsequent segment. First, as discussed above, Singhal does not operate at a segment level, and thus, does not determine any bit difference at the segment level. Second, the Examiner points to the variance processor 8 as discussed at column 5, lines 8-14, but the variance process does not do anything like determining a bit difference. Instead, the variance processor 8 simply compares DCT A-C coefficients within a single macroblock of either an input image or a differential image. Such a variance is simply irrelevant to a difference in the number of bits used to encode the first segment and the first segment bit allocation.

Singhal does not disclose determining a new target quantization step size for a subsequent segment based on a new target segment bit rate calculated using the new segment target bit rate and the distributed difference. First, as discussed above, Singhal is operating at the slice/macroblock level rather than at a segment level. Second, even if the slices of Singhal were somehow thought of as segments, Singhal still does not determine a target quantization step size for the slice/segment. Instead, Singhal only determines quantization steps sizes q(i) for individual macroblocks i (see equations 8 and 17 in columns 7-8).

For the foregoing reasons, claim 1 is not anticipated by Singhal.

Claims 2-3 depend on claim 1, and thus, are also not anticipated by Singhal. In addition, claim 3 highlights a further distinction with Singhal. Claim 3 recites that each segment includes at least one group of pictures. As discussed above, all of Singhal's operations occur at the frame, slice, and/or macroblock levels, which are all smaller than a group of pictures, and thus, cannot include a group of pictures.

Although the language of claims 12-14, 19, and 24 is not identical to that of claims 1-3, the allowability of claims 12-14, 19, and 24 will be apparent in view of the above discussion of claims 1-3.

The invention of claim 25 is also not disclosed by Singhal. Claim 25 recites a moving pictures encoder that includes a bit rate adjustment processor that determines a target bit rate from the number of bits already used for encoding successive pictures in a current group of pictures, a target encoding quantization step size, and an average quantization step size for pictures in the current group of pictures. Singhal does not disclose a bit rate adjustment processor that uses a target encoding quantization step size and an average quantization step size to determine a target bit rate. Instead, Singhal define the target bits for a slice or frame as the number of pre-assigned bits for encoding each slice or frame plus carry-over bits left-over from coding the previous slice or frame (col. 5, lines 52-55). Nothing in Singhal suggests calculating an average quantization step size or using such an average quantization step size to determining the target bits for a slice or frame. Accordingly, claim 25 is not anticipated by Singhal.

New claims 26-27 and 28-29 depend on claims 25 and 24, respectively. Accordingly, claims 26-29 are not anticipated by Singhal for the reasons expressed above. In addition, claims 26-29 recite other features not taught by Singhal. In particular, claims 26 and 28 recite features similar to allowable claim 4 and claims 27 and 28 recite features similar to allowable claim 15. Accordingly, new claims 26-29 are in condition for allowance.

The Examiner objected to the abstract for failing to commence on a separate sheet as specified in 37 CFR 1.52(b)(4). An abstract is being provided with a request to place it on a separate sheet.

The Examiner objected to the application, faxed to the Examiner on April 18, 2005, under 37 CFR 1.125(a) because all of the components were not filed separately. The applicants traverse the objection for two reasons. First, the application faxed to the Examiner on April 18, 2005, was not a substitute specification as discussed in 37 CFR 1.125(a). Instead, the faxed application was a courtesy copy of the published PCT application and was sent in response to a request of the Examiner by telephone on April 18, 2005. Second, 37 CFR 1.125(a) does not require all of the components of the application to be filed separately. Instead, that section simply indicates that the Office may require a substitute specification to be filed if the applicant is attempting to make numerous changes to the application.

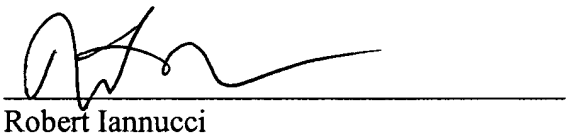
The Examiner also objected to the April 18, 2005, faxed application under 37 CFR 1.4(c) because the disclosure should have been submitted as a separate paper and the drawings should have been submitted as a separate paper. The applicants traverse the objection for two reasons. First, as discussed above, the April 18, 2005, faxed application was a courtesy copy of the published PCT application and was sent in response to a request of the Examiner by telephone on April 18, 2005. Second, 37 CFR 1.4(c) does not require the components of the application to be filed separately. Instead, 37 CFR 1.4(c) simply states that each different subject, inquiry, or order must be filed separately. Providing a faxed courtesy copy of an entire application does not involve more than one subject and is not an inquiry or order.

The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

SEED Intellectual Property Law Group PLLC



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Enclosure:
Postcard
6 Sheets of Replacement Drawings (Figures. 1-6)

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